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HISTORICAL BACKGROUND OF DIGITAL AUDIO DISC SYSTEMS

EARLY 70's

SEVERAL MAJOR ELECTRONIC COMPANIES ARE WORKING ON VIDEO DISC AND TAPE RECORDING SYSTEMS.

EUROPE: PHILIPS, TELEFUNKEN/DECCA, THOMSON, CSF, A.O.

USA : RCA, MCA, 3M, A.O.

JAPAN : JVC/MATSUSHITA, MITSUBISHI, PIONEER, SONY, TOSHIBA A.O.

TARGET:

CONSUMER VIDEO DISC AND TAPE RECORDING SYSTEMS COMPARABLE WITH SUCCESFULL GRAMOPHONE AND TAPE / COMPACT CASSETTE RECORDING SYSTEMS.

OPTIONS:

TECHNOLOGICAL PROGRESS IN OPTO-ELECTRONICS (LASERS, PHOTODIODES), OPTICS AND FINE MECHANICS, IC's AND MAGNETIC TAPE.

MID 70's

FIRST COMMERCIAL VIDEO DISC AND TAPE RECORDING SYSTEMS AVAILABLE. SEVERAL COMPANIES ARE WORKING ON PCM AUDIO SYSTEMS USING VIDEO DISC PLAYERS AND VTR'S.

1976: SONY INTRODUCED FIRST PCM AUDIO RECORDER FOR (SEMI) PROFESSIONAL APPLICATION.

LATE 70'S

FIRST OPTICAL VIDEO DISC PLAYERS COMMERCIALLY AVAILABLE (PHILIPS/MCA 1978).

FIRST PCM AUDIO DECODERS FOR VTR COMMERCIALLY AVAILABLE.

FIRST PCM AUDIO DISC SYSTEMS ANNOUNCED AND DEMONSTRATED.

1977: SONY (DAD)

MITSUBISHI / TEAC / TOKYO DENKA (LASER SOUND)

HITACHI / NIPPON COLUMBIA

SHOWED FIRST OPTICAL PCM AUDIO DISC DISC PLAYERS, USING LP SIZE (12") DISCS.

1978: JVC SHOWED FIRST MECHANICAL / CAPACITIVE (COMPATIBLE) VIDEO / PCM AUDIO DISC SYSTEM, USING LP SIZE DISCS (VHD/AHD)

1979: PHILIPS SHOWED FIRST OPTICAL COMPACT PCM AUDIO DISC SYSTEM (COMPACT DISC, Ø 11,5 CM).

TELEFUNKEN / TELDEC SHOWED FIRST MECHANICAL COMPACT PCM AUDIO DISC SYSTEM (MD: MINI DISC Ø 13,5 / MICRO DISC Ø 7,0 CM)

1980: PHILIPS AND SONY PUSHING COMPACT DISC DIGITAL AUDIO AS FUTURE DIGITAL AUDIO DISC WORLD STANDARD, FOLLOWED BY JVC (VHD / AHD) AND TELEFUNKEN (MD).

ALSO HITACHI, MITSUBISHI, PIONEER, SANYO, SHARP AND TOSHIBA DEMONSTRATED THEIR OPTICAL DAD DEVELOPMENTS DURING ALL JAPAN AUDIO FAIR.

POSITIONING OF DIGITAL AUDIO DISC SYSTEMS

PCM RECORDING IN PROFESSIONAL
SOUND STUDIO'S

HIGH INFORMATION DENSITY
VIDEO TAPE/DISC SYSTEMS

WITH SIMILAR BANDWIDTH REQUIREMENTS
MADE POSSIBLE

DIGITAL AUDIO DISC SYSTEMS

PCM IN SOUND REPRODUCTION

ADVANTAGES:

- INSENSITIVE TO ADDED NOISE
- NOW WOW AND FLUTTER
- PERFECT TRANSIENTS
- VERY LITTLE DISTORTION
- INCREASED FREQUENCY RANGE (LOW AND HIGH)

DISADVANTAGES:

- MORE COMPLEXITY
- HIGHER COST (INITIALLY)

DIGITAL AUDIO DISC SYSTEM IS A SYSTEM OF

1. PLAYERS

2. DISCS

FROM RECORDING TO PRESSING AND DISTRIBUTION

DAD SYSTEM IS NOT COMPATIBLE WITH GRAMOPHONE RECORDING

WHAT IS NECESSARY FOR SUCCESFULL IMPLEMENTATION?

- STANDARDISATION OF DISCS AND PLAYERS
- SUPPORT OF HARDWARE (SETMAKERS) AND SOFTWARE (MUSIC) INDUSTRY
- PLAYERS
- DISCS
 - REPLICATION FACILITIES
 - REPERTOIRE

WHICH DAD SYSTEM WILL SURVIVE? (REF. HiFi GRAMOPHONE/RECORD PLAYERS)

- POTENTIAL PLAYER TECHNOLOGIES IN VIEW OF COSTPRICE REDUCTION (EVENTUALLY NOT MORE EXPENSIVE THAN TODAY'S HiFi-PLAYER)
- LOWER DISC PROCESSING COST (EVENTUALLY CHEAPER DISCS)
- BETTER QUALITY INCL. LIFE TIME
- NEW APPLICATION POSSIBILITIES

DIGITAL AUDIO DISC SYSTEM PROPOSALS

READ-OUT	RECORDING	DISC	MATERIAL
PIEZO ELECTRIC CONTACT TELEFUNKEN (MD)	ELECTRO MECHA- NICAL	WITH GROOVE IN CASSETTE	PVC
CAPACITIVE CONTACT JVC (VHD/AHD)	LASER	WITHOUT GROOVE IN CASSETTE	PVC + CARBON
OPTICAL (NO CONTACT) PH./SONY (CD)		WITHOUT GROOVE NO CASSETTE	PMMA A.O. + METALISED SURFACE SEALED

DIGITAL AUDIO DISC MANUFACTURING PROPOSALS

	PIEZo-ELECTRIC SYSTEM WITH GROOVES	CAPACITIVE SYSTEM WITHOUT GROOVES	OPTICAL SYSTEM
RECORDING	DIRECT RECORDING ON METAL MASTER - - -	PHOTO RESIST LAQUERING LIGHT EXPOSURE OF RECORDING IN CLEAN ROOM DEVELOPMENT PROCESS	PHOTO RESIST LAQUERING LIGHT EXPOSURE OF RECORDING IN CLEAN ROOM DEVELOPMENT PROCESS
GALVANIC	- - STAMPER MAKING	SILVERING MASTER MAKING STAMPER MAKING	SILVERING MASTER MAKING STAMPER MAKING
DISC MANUFACTURING	PRESSING - -	PRESSING - -	PRESSING METALLIZING SEALING

DAD STANDARDIZATION CONFERENCE ACTIVITIES IN JAPAN

MEMBERS OF SUB-WORKING GROUP (WG3)

(JAN. 1981)

FOR EVALUATION OF DAD SYSTEM PROPOSALS

COMPANY	SUB-WORKING GROUP		
	A. AHD (JVC)	C. CD (PHILIPS/SONY)	M. MD (TELEFUNKEN)
AKAI	0	0	
ONKYO		0	
SANSUI	0	0	
SANYO		0	
SHARP	0	0	
GENERAL	0	0	
TEAC		0	
TOSHIBA	0	0	
TRIO		0	
YAMAHA	0		
COLUMBIA		0	
PIONEER		0	
HITACHI		0	
MATSUSHITA	0	0	
MITSUBISHII	0	0	
NEC	0	0	
TOTAL	9	15	0

MAJOR DEVIATING CHARACTERISTICS OF DAD SYSTEM PROPOSALS

JVC (VHD/AHD)

- COMPATIBILITY WITH VIDEO DISC SYSTEM (VHD).
FOR PLAYING DIGITAL AUDIO DISCS A (MORE COMPLICATED) VHD PLAYER IS REQUIRED AND AN ADDITIONAL PCM DECODER (DIFFERENT TV SYSTEMS REQUIRE DIFFERENT VHD PLAYERS AND DISCS: NO WORLD STANDARD IS POSSIBLE).
- DOUBLE SIDED 10" DISC IN CASSETTE.
- 2 OR 4 CHANNEL CAPABILITY OR 3-CHANNEL SOUND AND ONE CHANNEL FOR STILL TV PICTURES.
- MAX. PLAYING TIME OF 2X ONE HOUR.

TELEFUNKEN/TELDEC (MD)

- AUDIO ONLY.
- DISC MANUFACTURING IN CONVENTIONAL WAY (SMALL INVESTMENTS).
- DOUBLE SIDED COMPACT DISC (MINI DISC OF Ø 13.5 CM, MICRO DISC OF Ø 7.0 CM) IN CASSETTE.
- 2 CHANNELS (4 CHANNELS POSSIBLE FOR MINI DISC ONLY).
- MAX. PLAYING TIME 2X ONE HOUR (MINI DISC ONLY).
- QUANTIZATION 14 BITS.
- SIMPLE ERROR CORRECTION AND MODULATION SYSTEM.

PHILIPS/SONY (CD)

- AUDIO ONLY.
- SINGLE SIDE COMPACT DISC (Ø 12 CM), NO CASSETTE.
- 2 CHANNELS (4 CHANNELS POSSIBLE WITH REDUCED PLAYING TIME)
- MAX. PLAYING TIME ONE HOUR.
- POWERFUL ERROR CORRECTION AND MODULATION SYSTEM.
- NO MECHANICAL WEAR OF DISC AND PICK-UP.
- INFORMATION WELL PROTECTED INSIDE DISC.
- MOST ADVANCED TECHNOLOGY OPENING NEW HORIZONS OF APPLICATIONS (OUTDOOR HIFI, AUDIO/VIDEO DISC PLAYERS).

STANDARDISATION ACTIONS

DAD STANDARDISATIONS CONFERENCE IN JAPAN STARTED ACTIVITY IN 1978 AFTER INITIATIVE OF SOME ELECTRONIC INDUSTRIES AND MITI.

APPROX. 50 MEMBERS FROM HARDWARE AND SOFTWARE COMPANIES INCL. AEG/TELEFUNKEN, PHILIPS, RCA, THOMSON/CSF AND LOCAL BRANCHES OF FOREIGN RECORD MANUFACTURERS.

PLAN FOR STANDARDISATION:

AGREEMENT IN DAD STANDARDISATION CONFERENCE

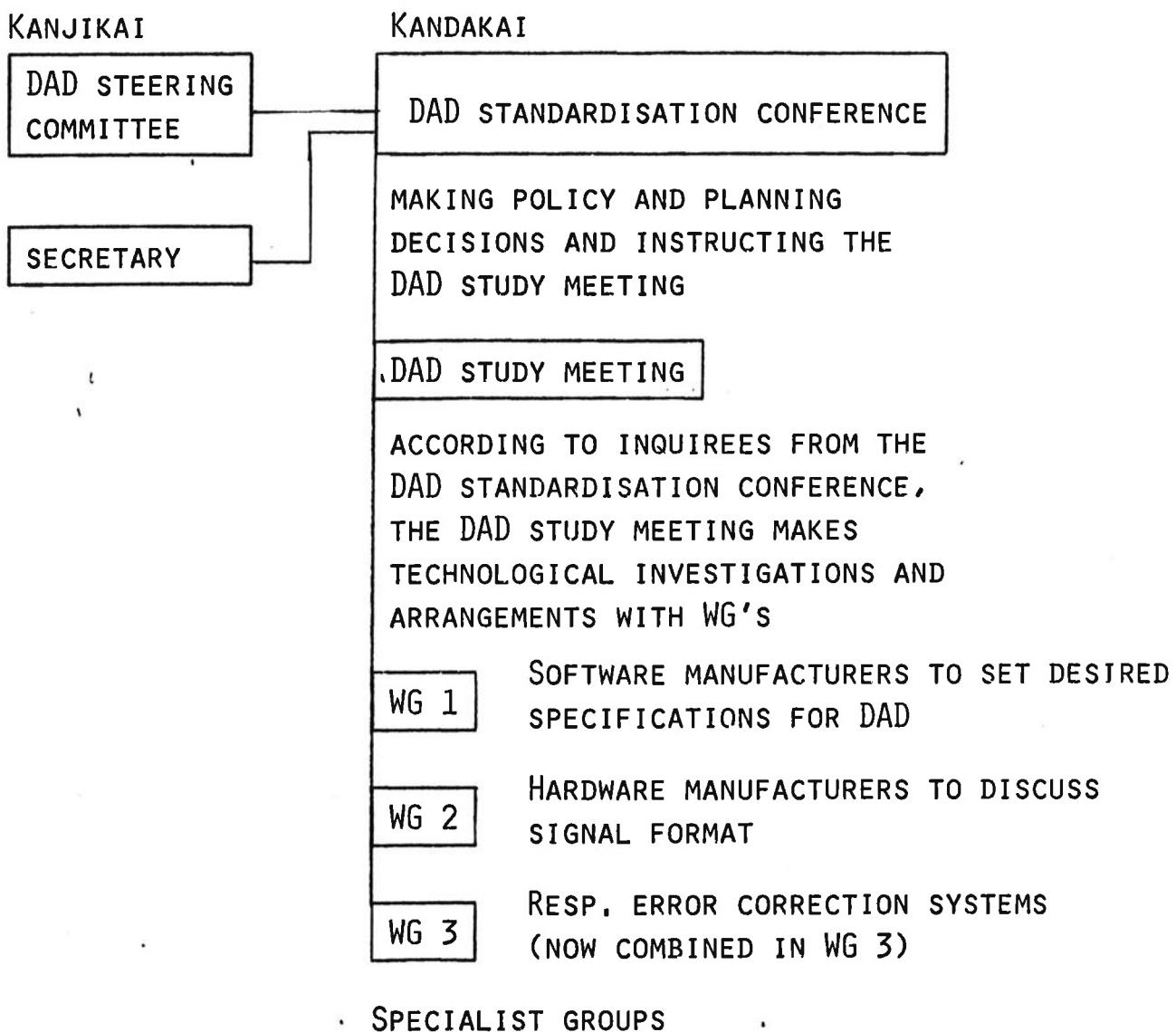


RECOMMENDATION TO EIAJ AND MITI



RECOMMENDATION TO IEC

PARALLEL DISCUSSIONS WITHIN:
AES, ITA, EBU, ETC. (DIGITAL AUDIO CIRCLES)



SINCE OCTOBER 1980 THREE SUB-WG'S 3A, C, M FOR EVALUATION OF
SYSTEM PROPOSALS FROM JVC, TELEFUNKEN/TELDEC AND PHILIPS/SONY RESP.

DAD STANDARDISATION CONFERENCE ACTIVITIES

SEPTEMBER 1978: START

NOVEMBER 1978: WG 1 PROPOSES TARGET SPECIFICATIONS OF DAD.
WG 2 AND 3 DISCUSSED TARGET SPECIFICATIONS AND
LISTED EXISTING SIGNAL FORMATS.

DECEMBER 1979: STUDY GROUP DISCUSSED WG PROPOSALS AND SENT OUT
QUESTIONNAIRE ON DAD SPECIFICATIONS.

APRIL 1979: 13 SYSTEM PROPOSALS PRESENTED TO STUDY GROUP.
THOSE PROPOSALS WERE ARRANGED BY WG 4:

1. CONCEPT OF PRODUCT DESIGN

- A. COMPACT SYSTEM FOR AUDIO PLAYBACK ONLY
- B. COMPACT SYSTEM COMPATIBLE WITH VIDEO DISC SYSTEMS (SAME PLAYER)
- C. PLAYER MECHANISM AS EQUAL AS POSSIBLE FOR VIDEO AND AUDIO PLAY BACK
- D. SYSTEM INTERCHANGEABLE WITH VIDEO DISC SYSTEMS. DAD PLAYABLE ON VIDEO DISC PLAYER.
SIGNAL FORMAT OF DAD CORRESPONDING WITH VIDEO DISC

2. ADAPTABILITY OF FORMAT

TO BE USED IN OPTICAL, CAPACITANCE AND MECHANICAL SYSTEMS.

3. SPECIFIC SYSTEMS

E.G. SAMPLING FREQUENCY, NUMBER OF BITS, REDUNDANCY, MODULATION SYSTEM

4. FUNCTIONAL ITEMS

E.G. NUMBER OF CHANNELS, ACCESS, PLAYING TIME,
DISC DIAMETER

OCTOBER 1979: WG 1 REVIEWED TARGET SPECIFICATIONS STRESSING REQUIREMENT OF A COMMON FORMAT AS WORLD-WIDE DAD WITHOUT ANY LIMITATION ON THE VIDEO FORMAT (SYSTEM D NEGLECTED FOR THE TIME BEING).

DECEMBER 1979: WG 4 REVIEWED CODING FORMATS FROM MEMBERS IN ORDER TO PREPARE TEST FORMAT (MARCH 1980) AND AFTER EXPERIMENTS TO PROPOSE STANDARD FORMAT TO STUDY MEETING (SEPTEMBER 1980) BASED ON AUDIO ONLY AND DISC SIZE AS SMALL AS POSSIBLE.

MARCH 1980: WG 4 DISCUSSED TEST FORMAT. DRAFT IS CLOSE TO PHILIPS ONE (PRESENTED FIRST IN MARCH 1979). PHILIPS IS REQUESTED TO DISCLOSE EXPERIMENTAL WORK.

APRIL 1980: CHAIRMAN OF WG 4 PROPOSED TO USE PHILIPS FORMAT AS ONE OF REPRESENTATIVE TEST FORMAT (NOTES 12 TO 11). STEERING COMMITTEE REQUESTED PHILIPS, JVC AND TELEFUNKEN FOR SUBMITTING THEIR FINAL PROPOSALS.

JUNE 1980: PHILIPS/SONY SUBMITTED NEW COMMON PROPOSAL (NEARER TO WG 4 TEST FORMAT). JVC AND TELEFUNKEN SUBMITTED THEIR SYSTEM PROPOSALS.

OCTOBER 1980: PHILIPS/SONY, JVC AND TELEFUNKEN DEMONSTRATED THEIR LATEST SYSTEMS. WG 3 STARTED TO EVALUATE THEIR SYSTEMS. PHILIPS/SONY ISSUED GENERAL INFORMATION OF CD TOT DAD MEMBERS. SUB WG 3C PREPARED QUESTIONNAIRE FOR PHILIPS/SONY WHICH WAS MOSTLY ANSWERED.

DECEMBER 1980: ON REQUEST OF SUB WG 3C PHILIPS/SONY DISCLOSED MORE INFORMATION OF THEIR SYSTEM AND SHOWED EXPERIMENTAL RESULTS. SUB WG 3M (TELEFUNKEN) WAS NOT ESTABLISHED BECAUSE OF LACK OF INTEREST. SUB WG 3A (JVC) WAS FINALLY ESTABLISHED AND GIVEN TIME UP TO END OF JANUARY 1981 TO EVALUATE JVC SYSTEM PROPOSAL.

TARGET SPECIFICATIONS OF DIGITAL AUDIO DISC
PREPARED BY DAD WG 1 (RECORD MANUFACTURERS)

NOVEMBER 1978

OCTOBER 1979

1. <u>PERFORMANCE</u>		
1.1 FREQUENCY RESPONSE)	(20-20 kHz)
1.2 DYNAMIC RANGE)	(80-90 dB)
1.3 DISTORTION)	AVERAGE QUALITY OF
1.4 SEPARATION)	MASTER TAPE
1.5 WOW AND FLUTTER)	BEST EFFORTS
1.6 NUMBER OF UNCORRECTED)	BEST EFFORTS
ERRORS		
NUMBER OF UNINTERPOLATED))
ERRORS))
2. <u>FUNCTION</u>		
2.1 RANDOM ACCESS	PLAYER CAPABLE OF LOCATING	ABSOLUTELY TO PERMIT CUEING OF EACH
	THE START OF SELECTIONS (REPE- TITIVE PLAY IF POSSIBLE)	RECORDED SEGMENT (TO PERMIT REPEAT IS
2.2 PREVENTION OF COPYING	PREVENTION OF DIGITAL COPY	NECESSARY)
	IS REQUIRED	PREVENTION OF DIGITAL COPYING IS NECESS- ARY
3. <u>DISC</u>		
3.1 DIAMETER	30 CM MAX. (20 CM DESIRABLE)	LESS THAN 20 CM IS DESIRABLE
3.2 AUDIO CHANNELS	4 (MONOX4, STEREOX2, ETC.)	4 (AT THE BEGINNING 2 CH. IS PERMITTED BUT COMPATABILITY WITH 2 CH. AND 4 CH. RECORDING, CHARACTER DISPLAY AND STILL PICTURES AT THE SAME SIZE REQUIRED)
3.3 PLAYING TIME	40 MIN. (CONTINUOUS)	40 MIN. (CONTINUOUS)
3.4 RECORDING METHOD	40-80 MIN. (PER DISC)	40-80 MIN. (PER DISC)
	CONSIDERING PRODUCTIVITY	REAL TIME MASTERING IS NECESSARY
4. <u>SIGNALS</u>		
4.1 QUANTISING BITS		LINEAR, FURTHER DISCUSSION ON 14 BITS OR 16 BITS REQUIRED
4.2 SAMPLING FREQUENCY		SAME AS DIGITAL MASTER
4.3 ERROR CORRECTION AND INTERPOLATION		
4.4 CONTROL SIGNAL		
4.5 MODULATION FORMAT		
5. <u>RELIABILITY</u>		
5.1 LIFE TIME	100 TIMES OR MORE	MORE THAN 100 PLAYING TIMES FOR ORDINARY USAGES
5.2 ANTI-DUST METHOD		TO BE STRONG AGAINST HANDLING (SCRATCHES, FINGERMARKS, ETC.) AND ENVIRONMENT (DUST)
5.3 HANDLING		
5.4 TOLERANCE	EQUAL TO ORDINARY RECORDS RECONSIDERATION	FURTHER DISCUSSION REQUIRED
6. <u>INTERCHANGEABILITY</u> <u>WITH VIDEO DISC</u>		
6.1	- VIDEO/AUDIO DISC INTER- CHANGEABLE PLAYER - WORLD-WIDE COMMON DAD	A COMMON FORMAT FOR ALL DAD SYSTEMS WORLD-WIDE, INDEPENDANT FROM VIDEO FORMAT FURTHER DISCUSSION REQUIRED ABOUT COMPATIBILITY BETWEEN VIDEO AND DAD
7. <u>PRODUCTION</u>		
7.1		COMPATIBILITY WITH PRESENT MASTERING PROCESS AND PRODUCTION FACILITIES TO BE CONSIDERED RECYCLING OF MATERIAL IS CONSIDERABLY IMPORTANT
8. <u>MISCELLANEOUS</u>		
8.1 PORTABLE PLAYER		NECESSARY